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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/685,588	10/16/2003	Chia-Lin Hsu	025796-00009	5130

7590 11/15/2005

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EXAMINER

EVERHART, CARIDAD

ART UNIT	PAPER NUMBER
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2891

DATE MAILED: 11/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/685,588	HSU ET AL.	
	Examiner	Art Unit	
	Caridad M. Everhart	2891	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 August 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4 and 6-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

### Response to Arguments

Applicant has amended to include the limitation "interconnect layer" and "of said metal interconnect layer".

Applicant has argued that Uzoh fails to disclose planarizing before the removal of the edge metal, and that the copper deposited by Uzoh is a seed layer. Applicant further argues that the secondary references fail to teach the feature that Uzoh fails to disclose.

Applicant's arguments with respect to claim 1-4, 6-29 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-4, 16-19, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh, et al. (US 6,140,234).

Uzoh, et al disclose forming a metal interconnection pattern on a wafer(col. 1, lines 26-28). A thin barrier layer is formed which may be Ta or TaN(col. 2, lines 30-35). The method of deposition is sputtering, which is a PVD method(col. 2, lines 34-36). Copper is used for the metal pattern(col. 1, lines 11-15). The copper seed layer is formed by sputtering(col. 3, lines 55-57). CMP is used to planarize the layer (col. 2, lines 2, lines 8-10), as it is disclosed that CMP is known as the method of planarizing the layer. Unwanted exposed edge barrier may be removed by edge bead removal (col.

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6, lines 11-18). The barrier at the edge was left exposed after the unwanted metal was removed (col. 2, lines 50-65). The exposed barrier is removed by RIE or by CMP(col. 2, lines 61-65). Uzoh, et al discloses that there may be an anneal step(col. 3, lines 57-65). Although it is disclosed that this step is not preferred, it is still disclosed as a possible step. Fig. 4 shows that the metal is planarized.

Uzoh et al does not teach the formation of the copper fill layer prior to the planarization. Uzoh et al fills the copper layer after the edge material removal in order to form the copper selectively, as the copper will form only in the trenches, where the barrier and seed layers remain.

It would have been obvious to one of ordinary skill in the art to have used the method of removing the edge material taught by Uzoh et al after the metal fill material because Uzoh et al discloses in the Background of the Invention section of the disclosure that in the prior art the metal layer is deposited in a blanket deposition and then planarized by CMP (1, lines 58-67).

Claims 10,11,13,15,20, 21,232, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh, et al in view of Emami, et al (US 6,857,941).

Uzoh, et al does not teach the backside material removal nor the drying of the wafer.

backside unwanted metal nor the drying of the wafer.

Emami et al disclose the chemical-mechanical polishing of the edge of a wafer(col. 8, lines 63-65). The polishing solution may be a slurry(col. 7, lines 29-40 and col. 13, lines 40-45).

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It would have been obvious to one of ordinary skill in the art at the time of the invention that the teachings of Uzoh, et al could be combined with the teachings of Emami, et al because the edge bead removal could then be done with the polishing apparatus.

Claims 12, 24, 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh, et al as applied to claim 1 above, and further in view of Vines et al (US 608789).

Uzoh, et al is silent with respect to nitric and hydrofluoric acid solution.

Vines et al teach that nitric and hydrofluoric acids are useful for cleaning wafers after CMP in the formation of metallization (abstract and col. 5, lines 1-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have combined the step taught by Vines et al with the process taught by Uzoh, et al teach removal of barrier layer removal, which can be done using the acids taught by Uzoh, et al.

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh, et al as applied to claim 1 above, and further in view of Kaufman, et al (US 2004/0009671A1).

Uzoh, et al is silent with respect to the pH of a slurry for the CMP step.

Kaufman et al teach the pH for removal of excess metal between 5.0 to 9.0, which overlaps the recited range.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the pH taught by Uzoh, et al in the process taught by Uzoh, et al in order to remove the excess metal in the pH range which is taught by Kaufman et al to be preferred for copper.

Claims 14, 27, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh, et al in view of Emami and Uzoh et al in view of Vines as applied to claims 13 and 23 above, and further in view of Sugai(JP2001044156).

Uzoh et al in view of Emammi and Uzoh, et al in view of Vines are silent with respect to a basic slurry for CMP.

Sugai discloses a pH in the basic range and which includes the recited range for the materials of the barrier disclosed by Uzoh, et al.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the pH range disclosed by Sugai in the process taught by Uzoh, et al in view of Emami and Uzoh, et al in view of Vines because the barrier is made of the materials disclosed by Sugai.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

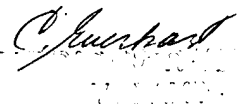
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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, B. Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



C. Everhart  
11-12-05